REQUEST FOR APPROVAL
LOCAL OPTIONAL SCOPE OF PRACTICE

EMS MEDICAL DIRECTOR: Humberto Ochoa, M.D. DATE: February 14, 2003

LOCAL EMS AGENCY: Riverside County

NAME OF PROPOSED PROCEDURE OR MEDICATION: Trial Study on the Use of the Melker Kit for Needle Cricothyrotomy

1. DESCRIPTION OF THE PROCEDURE OR MEDICATION REQUESTED:
   Use of the Melker Emergency Cricothyrotomy Catheter Kit to perform prehospital cricothyrotomy.

2. DESCRIPTION OF THE MEDICAL CONDITIONS FOR WHICH THEY WILL BE UTILIZED:
   See attached.

3. ALTERNATIVES (Please describe any alternate therapies considered for the same conditions and any advantages and disadvantages):
   See attached.

4. PATIENT POPULATION THAT WOULD BENEFIT, INCLUDING AN ESTIMATE OF FREQUENCY OF UTILIZATION:
   See attached.

5. OTHER FACTORS OR EXCEPTIONAL CIRCUMSTANCES:
   See attached.

PLEASE ATTACH:

6. ANY SUPPORTING DATA, INCLUDING RELEVANT STUDIES AND MEDICAL LITERATURE.

7. RECOMMENDED POLICIES/PROCEDURES TO BE INSTITUTED REGARDING USE, MEDICAL CONTROL, TREATMENT PROTOCOLS, AND QUALITY ASSURANCE OF THE PROCEDURE OR MEDICATION.

8. DESCRIPTION OF THE TRAINING AND COMPETANCY TESTING REQUIRED TO IMPLEMENT THE PROCEDURE OR MEDICATION.

Riverside County
Optional Scope of Practice /Pilot Study
Request for Approval
Form answers – page 1 of 3

Item 1 -- Description of procedure
Use of the Melker Emergency Cricothyrotomy Catheter Kit to perform prehospital Cricothyrotomy.

Item 2 -- Medical conditions for which utilized
Performing a cricothyrotomy will be the procedure of last resort in those patients with complete airway blockage in which all other means of ventilation have failed. ***This procedure will only be used on those patients who are over the age of eight (8) years. Those eight years of age and younger will have standard, age-appropriate BLS measures, and non-invasive ALS measures performed (see Item 3 below)***

Item 3 -- Alternatives
Alternative means of ventilation that would take precedence prior to attempting needle cricothyrotomy include all BLS and ALS procedures for airway manipulation, including, but not limited to:

Heimlich maneuvers
Insertion of OP or NP airways
Suction
Bleeding control
Use of Magill forceps
Drug therapy (albuterol HHN, ipratropium HHN, epinephrine SQ)
Insertion of ETT
Insertion of Combi-tube

Item 4 -- Patient population that would benefit, including an estimate of frequency
Those patients with conditions/ injuries that could produce complete airway blockage, including, but not limited to

--- foreign body aspiration
--- edema 2^0 to anaphylaxis / inflammatory response
--- isolated trauma to the neck and/or face
--- tumor

We anticipate use of this procedure on less than 1/100th of 1% of our patient population – not more than 3 – 4 persons per year in Riverside County.

Item 5 -- Other factors or exceptional circumstances
Needle cricothyrotomy is a procedure included in the standard scope of practice for paramedics, using a 10-gauge needle. It is our belief that a 10-gauge needle, even using translaryngeal jet ventilation (TLJV) remains an insufficient method for effective ventilation. Additionally, the manipulation of the TLJV can increase the risk of displacement. The Melker kit allows for a larger, more effective airway, yet attains placement only after proper location has been verified with a much smaller diameter device. Once placed, a simple BVM can be attached for ventilation purposes. We believe the Melker kit provides not only more effective ventilation, but is a safer, more secure method of obtaining and maintaining it as well.

Item 6 -- Supporting data
See attached -- cricothyrotomy kit comparison table
-- research abstracts

Item 7 -- Policies, procedures and quality assurance methods
See attached policies and procedures

Quality assurance will be instituted via 100% incident audit.
Prehospital personnel attempting this procedure will be required to complete the attached form and turn it, along with a copy of the patient care record (PCR), into their quality assurance coordinator. The quality assurance coordinator will immediately copy it and forward it to the EMS agency. The EMS Agency will conduct their investigation by:

Reviewing the attached form
Reviewing the patient care record (PCR)
Interviewing the prehospital crew
Interviewing the receiving ED physician
Obtaining and reviewing the ED/hospital record for the patient

Data to be collected will include:

1. Patient information – sex, age and weight
2. Pathophysiology necessitating the procedure (FBAO, anaphylaxis, etc)
3. Other airway maintenance options attempted
4. Time frames – to complete procedure, on-scene, transport
5. Success of placement
6. Patient improvement
7. Difficulties encountered
8. Complications of procedure
9. Patient outcome
10. Paramedic comfort level

Questions to be answered include:

1. ***What patient populations in Riverside County require use of needle cricothyrotomy?***
2. ***What pathophysiology is encountered that necessitates a needle cricothyrotomy and how does that relate to specific patient populations in Riverside County?***
3. ***Are other methods of airway maintenance being thoroughly explored?***
4. ***Are overall time frames for procedure implementation and arrival to definitive care supporting the use of needle cricothyrotomy in the field?***
5. ***What is the percentage of successful placement of the Melker airway?***
6. ***What is the percentage of patient improvement and how does that correlate with successful placement?***
7. ***What is the percentage of patient survivability to discharge (from acute care) when this procedure is performed?***

8. ***What is the complication rate of this procedure, and what complications occur most frequently?***
9. ***What is the level of comfort for paramedics performing this procedure, and how can this be optimized?***

Data will be collected and reviewed on an on-going basis. At any time, should the data reveal that use of the Melker Kit creates an unacceptable risk to patients and/or prehospital personnel, the study shall be immediately suspended.

Item 8 -- Training and competency testing
See attached training materials

Paramedics will attend a minimum 4-hour training program where needle cricothyrotomy is but one part of an overall airway management review.

The class will consist of lecture and Power Point presentation on anatomy and physiology, pathophysiology, airway assessment measures, review of basic and advanced treatment options, and policy and procedure. It will be integrated with a skills section that will include review of basic and advanced airway maintenance practices in addition to teaching use of the Melker Kit. Both didactic and skills examinations will be given at the end.

Instructors for this class will have completed a train-the-trainer course covering course materials, testing procedures, and data collection.

Every six (6) months, personnel will be required to attend a skills review/practice session that utilizes the same skills sheets as the original training. Instructors will be polled as to
1) those topics/skills steps most frequently observed to be forgotten and/or difficult for participants.
2) those teaching techniques that appear to be most helpful to the students

Questions to be answered:
1. ***Is use of the Melker Kit too complex a procedure to obtain and maintain proficiency within the paramedic population?***
2. ***Are every 6 month skills reviews adequate to maintain proficiency AND a minimum comfort level in the paramedic population?***
3. ***Is skills maintenance for this procedure cost effective from a use vs benefit perspective?***

Item 6 -- Supporting data

CRICOTHYROTOMY KIT COMPARISON

MODEL	SPECIAL CHARACTERISTICS	LUMEN SIZE	COST	BVM COMPATABLE?	TRNG MATERIALS AVAILABLE?
Enk Oxygen Flow Modulator	Uses regular needle/catheter only -- manual O2 flow control	2 mm inner diameter (6 Fr)	~$50	no	
Patil	Looks like a smaller version of the Rusch --uses scalpel	2, 3 mm inner diameter (6 & 9 Fr)	~$54	yes	
Arndt	Looks like a smaller version of the Rusch --uses a guidewire	3 mm inner diameter (9 Fr)	~$54	yes thru flex tubing	
Melker	Used in many local EDs Uses regular needle, guidewire, scalpel, dilator	3.5, 4 mm inner diameter (9.5 Fr)	~$87	yes	Video and printed materials, maybe slides. CD-ROM on genl airway matters
Cook Emergency Kit (AT-400)	Uses regular needle/catheter only -- uses 3-way stopcock for thumb or valve O2 control	2mm (6 Fr, 12 g)	~$44	no	

☑ Related Articles

TITLE: Cricothyrotomy performed by prehospital personnel: a comparison of two techniques in a human cadaver model.

AUTHORS: Johnson DR; Dunlap A; McFeeley P; Gaffney J; Busick B

AUTHOR AFFILIATION: Department of Emergency Medicine, New Mexico Emergency Medical Services Academy, University of New Mexico, Albuquerque 87131.

SOURCE: Am J Emerg Med 1993 May;11(3):207-9.

CITATION IDS: PMID: 8489658 UI: 93256999

COMMENT IN: Am J Emerg Med. 1993 May;11(3):310
Am J Emerg Med. 1994 Jan;12(1):124-5

ABSTRACT: Little is known about the proficiency of prehospital personnel when performing cricothyrotomies. The authors compared two techniques for establishing an airway through the cricothyroid membrane used by paramedic students. One technique used a prepackaged kit that consisted of a dilator that is passed percutaneously through a breakaway needle. This percutaneous device (PD) was compared with a standard surgical approach (SA) using a scalpel and endotracheal tube. Data was collected on a total of 44 paramedic students who were allowed to attempt each of the procedures. No significant difference in the success rate on the first attempt was found between the two procedures (86% for the SA and 73% for the PD; P = .186). The surgical approach was significantly faster (46 +/- 17 seconds v 103 +/- 62 seconds; P < .01). It was also judged to be significantly easier to perform when evaluated on a linear analog scale (SA, 2.6 +/- 2.0 v PD, 5.1 +/- 2.8; P < .001). Because some procedures were performed on cadavers whose cricothyroid membranes had already been violated, the procedures performed on intact membranes only were also analyzed. Similar, statistically significant differences for insertion time and ease of insertion were again found. Prehospital personnel can be trained to perform cricothyrotomies with a reasonable degree of proficiency. A traditional surgical approach, however, may be faster and less difficult to perform than a comparable procedure using a commercially available percutaneous device.

MAIN MESH HEADINGS:
Cricoid Cartilage/*surgery
*Emergency Medical Technicians
Thyroid Cartilage/*surgery
Tracheotomy/*methods

ADDITIONAL MESH HEADINGS:
Airway Obstruction/surgery
Cadaver
Comparative Study
Human
Tracheotomy/instrumentation
1993/05
1993/01

PUBLICATION TYPES: Journal Article

LANGUAGES: eng

☑ Related Articles | External Links

TITLE: Emergency cricothyroidotomy in trauma victims.

AUTHORS: Salvino CK; Dries D; Gamelli R; Murphy-Macabobby M; Marshall W

AUTHOR AFFILIATION: Loyola University Medical Center, Maywood, IL 60153.

SOURCE: J Trauma 1993 Apr;34(4):503-5.

CITATION IDS: PMID: 8487335 UI: 93253821

ABSTRACT: The first dictum of trauma care is to establish an airway. Infrequently endotracheal intubation is unsuccessful or contraindicated, and a surgical airway is required. We reviewed 30 emergency cricothyroidotomies among 8320 admissions over a 36-month period at a level I trauma center. Twenty cricothyroidotomies were performed in the emergency room by Trauma Service personnel and 10 during prehospital care by flight nurses. Cricothyroidotomy was the first airway control maneuver performed in 7 patients and 23 cricothyroidotomies were performed after attempts at oral intubation failed. No major complications were identified. Minor complications identified in the hospital included minimal subglottic stenosis (2), local wound infection (1), and nonthreatening hemorrhage (1). Fifteen patients were long-term survivors. We conclude that emergency cricothyroidotomy is a safe and rapid means of obtaining an airway when endotracheal intubation fails or is contraindicated.

MAIN MESH HEADINGS:
Airway Obstruction/*surgery
Cricoid Cartilage/*surgery
Thyroid Cartilage/*surgery
Wounds and Injuries/*surgery

ADDITIONAL MESH HEADINGS:
Emergencies
Human
Retrospective Studies
Tracheotomy
1993/04
1993/01

PUBLICATION TYPES: Journal Article

LANGUAGES: eng

Related Articles | External Links

TITLE: Acute airway management. Role of cricothyroidotomy.

AUTHORS: DeLaurier GA; Hawkins ML; Treat RC; Mansberger AR

AUTHOR AFFILIATION: Department of Surgery, Medical College of Georgia, Augusta 30912.

SOURCE: Am Surg 1990 Jan;56(1):12-5.

CITATION IDS: PMID: 2294806 UI: 90103287

ABSTRACT: Thirty-four cases of emergency cricothyroidotomy performed formed from September 1984 through January 1988 are reviewed. Thirty-one of the cases were required out of 2,200 acute-trauma patients. The indication for cricothyroidotomy was inability to establish an airway by intubation usually in a situation of possible neck injury or severe facial trauma. Fourteen of the patients died as a result of their injuries, 13 of these in the first several hours after injury. The 20 surviving patients are studied in two groups: eleven patients whose cricothyroidotomy remained in place until decannulation (group I) and nine patients who underwent tracheostomy subsequent to cricothyroidotomy (group II). Clinical follow-up included physical examination in all survivors and endoscopic evaluation in twelve patients. Three minor complications were discovered in each of the two groups and two major complications were noted in group II. The major complications included a case of tracheal stomal stenosis requiring tracheal resection and a case of partially obstructing tracheal granulation tissue requiring endoscopic resection. This study supports the use of emergency cricothyroidotomy in situations in which intubation is not successful or thought to be safe. Data is also presented that suggests that tracheostomy subsequent to emergency cricothyroidotomy does not necessarily reduce airway-related morbidity in these patients.

MAIN MESH HEADINGS:
Cricoid Cartilage/*surgery
Laryngeal Cartilages/*surgery
*Respiration, Artificial
Thyroid Cartilage/*surgery
*Tracheotomy

ADDITIONAL MESH HEADINGS:
Airway Obstruction/therapy
Craniocerebral Trauma/therapy
Emergencies
Human
Neck/injuries
Neck Injuries
Postoperative Complications
Tracheal Stenosis/etiology
Wounds and Injuries/therapy
1990/01
1990/01

PUBLICATION TYPES: Journal Article

LANGUAGES: eng

Related Articles

TITLE: Prehospital cricothyrotomy: an investigation of indications, technique, complications, and patient outcome.

AUTHORS: Spaite DW; Joseph M

AUTHOR AFFILIATION: Section of Emergency Medicine, University of Arizona College of Medicine, Tucson.

SOURCE: Ann Emerg Med 1990 Mar;19(3):279-85.

CITATION IDS: PMID: 2310067 UI: 90178771

ABSTRACT: The records of all patients who presented to a Level 1 trauma center during a two-year period for whom a prehospital cricothyrotomy was attempted or ordered were reviewed. Twenty patients met the study criteria. The average age was 37 years (range, 11 to 65 years). Indications for prehospital cricothyrotomy were massive facial trauma (eight), failed oral intubation (seven), and suspected cervical-spine injury (one). Cricothyrotomy was attempted in 16 patients (80%), with the remaining four having the procedure ordered but not attempted. A successful airway was achieved in 14 patients (88%). Horizontal incisions were used in all cases and were anatomically correct in 15 of 16 attempts (94%). The overall immediate complication rate was 31%. Two patients (12%) sustained major complications (failure to obtain an airway). No hemorrhagic complications occurred, but 16 of the 20 were in cardiac arrest in the field. Long-term complications were not evaluated. All patients sustained major injuries (mean Injury Severity Score, 53.7), except one patient who suffered airway obstruction from food. Three patients (15%) survived; two of the three suffered permanent, severe brain dysfunction. These preliminary findings demonstrate that prehospital cricothyrotomy is being used chiefly in massively injured patients who are already beyond recovery. It is thus difficult to assess whether the procedure is either safe or effective. There is a need for further investigation to determine whether prehospital cricothyrotomy has any beneficial effect on outcome and, if so, in what setting.(ABSTRACT TRUNCATED AT 250 WORDS)

MAIN MESH HEADINGS:
Cricoid Cartilage/*surgery
Emergency Medical Services/*standards
Laryngeal Cartilages/*surgery
*Outcome and Process Assessment (Health Care)
Thyroid Cartilage/*surgery
Tracheotomy/*methods

ADDITIONAL MESH HEADINGS:
Adolescence
Adult
Aged
Airway Obstruction/surgery
Arizona
Child
Facial Injuries/complications
Female
Human
Injury Severity Score
Intubation, Intratracheal
Male

Related Articles

TITLE: Surgical cricothyroidotomy in trauma patients: analysis of its use by paramedics in the field.

AUTHORS: Jacobson LE; Gomez GA; Sobieray RJ; Rodman GH; Solotkin KC; Misinski ME

AUTHOR AFFILIATION: Indiana University School of Medicine, Indianapolis, USA.

SOURCE: J Trauma 1996 Jul;41(1):15-20.

CITATION IDS: PMID: 8676411 UI: 96291307

ABSTRACT: OBJECTIVE: To analyze the indications for and the success rate, complications, and neurologic outcomes of surgical cricothyroidotomy when performed in the field by ambulance paramedics. METHODS: The ambulance and hospital records of all trauma patients on whom a surgical cricothyroidotomy was attempted in the field by ambulance paramedics over a 5-year period were reviewed. A telephone survey of survivors was used to assess long-term complications and neurologic outcome. RESULTS: Surgical cricothyroidotomy was attempted on 50 patients, or 9.8% of those requiring definitive airway control. The most common indications were clenched teeth, blood or vomit obscuring visualization of the upper airway, severe maxillofacial injuries, and inaccessibility because the patient was trapped. Airway establishment was successful in 47 patients (94%). Major complications occurred in 2 patients (4%), where inadvertent dislodgement of the tube developed, requiring replacement. No patient developed significant subglottic stenosis. Nineteen patients (38%) survived and no patient died because of an inadequate airway. Evaluation of neurologic outcome revealed 12 patients (63%) with no significant deficits, 3 (16%) with moderate disability, 2 (10%) with severe disability, and only 2 in a persistent vegetative state. CONCLUSIONS: Surgical cricothyroidotomy can be performed on the critically injured patient in the field by ambulance paramedics with a high success rate and a low complication rate. The use of surgical cricothyroidotomy should be included in airway protocols for well-trained, ambulance Advanced Life Support paramedics.

MAIN MESH HEADINGS:
Cricoid Cartilage/*surgery
Resuscitation/*methods
Wounds and Injuries/*surgery

ADDITIONAL MESH HEADINGS:
Adolescence
Adult
Aged
Emergencies
Emergency Medical Technicians
Female
Human
Indiana
Male
Middle Age
Retrospective Studies
Treatment Outcome
1996/07
1996/01

☑ Related Articles | External Links

TITLE: Comparison of conventional surgical versus Seldinger technique emergency cricothyrotomy performed by inexperienced clinicians.

AUTHORS: Eisenburger P; Laczika K; List M; Wilfing A; Losert H; Hofbauer R; Burgmann H; Bankl H; Pikula B; Benumof JL; Frass M

AUTHOR AFFILIATION: Department of Internal Medicine I, University of Vienna, Austria.

SOURCE: Anesthesiology 2000 Mar;92(3):687-90.

CITATION IDS: PMID: 10719947 UI: 20182866

ABSTRACT: BACKGROUND: Cricothyrotomy is the ultimate option for a patient with a life-threatening airway problem. METHODS: The authors compared the first-time performance of surgical (group 1) versus Seldinger technique (group 2) cricothyrotomy in cadavers. Intensive care unit physicians (n = 20) performed each procedure on two adult human cadavers. Methods were compared with regard to ease of use and anatomy of the neck of the cadaver. Times to location of the cricothyroid membrane, to tracheal puncture, and to the first ventilation were recorded. Each participant was allowed only one attempt per procedure. A pathologist dissected the neck of each patient and assessed correctness of position of the tube and any injury inflicted. Subjective assessment of technique and cadaver on a visual analog scale from 1 (easiest) to 5 (worst) was conducted by the performer. RESULTS: Age, height, and weight of the cadavers were not different. Subjective assessment of both methods (2.2 in group 1 vs. 2.4 in group 2) and anatomy of the cadavers (2.2 in group 1 vs. 2.4 in group 2) showed no statistically significant difference between both groups. Tracheal placement of the tube was achieved in 70% (n = 14) in group 1 versus 60% (n = 12) in group 2 (P value not significant). Five attempts in group 2 had to be aborted because of kinking of the guide wire. Time intervals (mean +/- SD) were from start to location of the cricothyroid membrane 7 +/- 9 s (group 1) versus 8 +/- 7s (group 2), to tracheal puncture 46 +/- 37s (group 1) versus 30 +/- 28s (group 2), and to first ventilation 102 +/- 42s (group 1) versus 100 +/- 46s (group 2) (P value not significant). CONCLUSIONS: The two methods showed equally poor performance.

MAIN MESH HEADINGS:
*Emergency Medical Services
Larynx/*surgery
Respiratory Muscles/*surgery
Respiratory System/*surgery
*Surgical Procedures, Operative
Thyroid Cartilage/*surgery

ADDITIONAL MESH HEADINGS:
Aged
Cadaver
Comparative Study
Female
Human
Intensive Care Units
Larynx/anatomy & histology
Male
Middle Age
Neck/anatomy & histology
Respiratory Muscles/anatomy & histology

Related Articles | External Links

TITLE: Extra inspiratory work of breathing imposed by cricothyrotomy devices.

AUTHORS: Ooi R; Fawcett WJ; Soni N; Riley B

AUTHOR AFFILIATION: Magill Department of Anaesthesia, Westminster Hospital, London.

SOURCE: Br J Anaesth 1993 Jan;70(1):17-21.

CITATION IDS: PMID: 8431326 UI: 93159924

ERRATUM IN: Br J Anaesth 1993 Apr;70(4):494

ABSTRACT: Using a lung model for spontaneous ventilation, we have assessed the additional work of inspiration imposed by a variety of cannulae ranging from the 12- and 14-gauge intravascular cannulae to the 8.0-mm i.d. adult tracheostomy tube. Work (W) ranged between 9 and 2262 mJ litre-1 and power (W) between 0.2 and 37.7 mW litre-1 min; the smallest values were obtained with the 8.0-mm i.d. adult tracheostomy tube and the 12- and 14-gauge intravascular cannulae gave the largest values. With any given cannula, W and W were influenced by ventilation (tidal volume and frequency) and ventilatory wave pattern of the analogue lung. The results obtained from the 12- and 14-gauge cannulae represent what is probably an excessive inspiratory workload, whereas the other four devices (Portex MiniTrach, 4.0, 6.0 and 8.0 tracheostomy tubes) may be suitable in the short term for relieving airway obstruction and compatible with spontaneous ventilation.

MAIN MESH HEADINGS:
*Models, Biological
Tracheostomy/*instrumentation
Work of Breathing/*physiology

ADDITIONAL MESH HEADINGS:
Comparative Study
Cricoid Cartilage/surgery
Human
Pulmonary Ventilation/physiology
Support, Non-U.S. Gov't
Tidal Volume/physiology
Time Factors
1993/01
1993/01

PUBLICATION TYPES: Journal Article

LANGUAGES: eng

☑ Related Articles | External Links

TITLE: Comparison of wire-guided cricothyrotomy versus standard surgical cricothyrotomy technique.

AUTHORS: Chan TC; Vilke GM; Bramwell KJ; Davis DP; Hamilton RS; Rosen P

AUTHOR AFFILIATION: Department of Emergency Medicine, University of California San Diego School of Medicine, 92103-8676, USA.

SOURCE: J Emerg Med 1999 Nov-Dec;17(6):957-62.

CITATION IDS: PMID: 10595879 UI: 20061328

ABSTRACT: We compared a wire-guided cricothyrotomy technique vs. standard surgical cricothyrotomy in terms of accuracy in placement, complications, performance time, incision length, and user preference. We conducted a randomized, crossover controlled trial in which Emergency Medicine (EM) attendings and residents performed cricothyrotomies by both standard and wire-guided techniques (using a commercially available kit) on human cadavers after a 15-min training session. Procedure time, incision length, and physician preference were recorded. Cadavers were inspected for accuracy of placement and complications. Airway placement was accurate in 13 of 15 cases for the standard technique (86.7%), and 14 of 15 cases for the wire-guided technique (93.3%). When comparing wire-guided vs. standard techniques, there were no differences in complication rates or performance times. The wire-guided technique resulted in a significantly smaller mean incision length than the standard technique (0.53 vs. 2.53 cm, respectively, $p<0.0001$). Overall, 14 of 15 physicians stated that they preferred the wire-guided to the standard technique. Our data suggest that this wire-guided cricothyrotomy technique is as accurate and timely to use as the standard technique and is preferred by our physician operators. In addition, the technique results in a smaller incision on human cadaver models.

MAIN MESH HEADINGS:
Cricoid Cartilage/*surgery
Emergency Medicine/*education

ADDITIONAL MESH HEADINGS:
Attitude of Health Personnel
Cadaver
Comparative Study
Cross-Over Studies
Equipment Design
Human
Support, Non-U.S. Gov't
Surgical Instruments
Time Factors
1999/12
1999/14 09:00

PUBLICATION TYPES:
Clinical Trial
Journal Article
Randomized Controlled Trial

LANGUAGES: eng

Related Articles | External Links

TITLE: A new emergency cricothyroidotomy instrument.

AUTHORS: Weiss S

SOURCE: J Trauma 1983 Feb;23(2):155-8.

CITATION IDS: PMID: 6827636 UI: 83138926

ABSTRACT: Cricothyroidotomy is an excellent emergency procedure for airway obstruction which cannot be relieved by oral or nasal intubation. Important factors for a device for emergency cricothyroidotomy include selective airways, an airway lumen of sufficient size to permit suctioning or adequate airflow during spontaneous breathing, and the ability to assess depth and angle of penetration. An instrument that is simple to insert, offers protection against overpenetration, minimizes bleeding, and provides an airway offering a variety of lumens is described. It appears to provide an ideal means of accomplishing an emergency cricothyroidotomy for airway obstruction.

MAIN MESH HEADINGS:
Airway Obstruction/*surgery
Cricoid Cartilage/*surgery
*Emergencies
Laryngeal Cartilages/*surgery
Thyroidectomy/*instrumentation

ADDITIONAL MESH HEADINGS:
Human
Resuscitation
1983/02
1983/01

PUBLICATION TYPES: Journal Article

LANGUAGES: eng

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Item 7 -- Policies, procedures and quality assurance methods

OPERATIONS: Adult Treatment Protocols (ALS)

Policy: 7830
Date: 8/01/02

RESPIRATORY EMERGENCIES

AIRWAY OBSTRUCTION

		PRIOR TO CONTACT
1.	SECURE AIRWAY (BLS)	Following BLS procedures, attempt to position and open airway. Ensure completion of at least 2 full cycles of FBAO maneuvers. Refer to Policy # 6830, Airway Obstruction. Suction as needed.
2.	SECURE AIRWAY (ALS)	Visualize airway and attempt to clear obstruction with Magill forceps. If partial obstruction, determine appropriateness and attempt ETT or MLA. If complete obstruction exists, *prepare* for needle cricothyrotomy while also preparing patient for transport.
3.	TRANSPORT	Once complete airway obstruction is determined, immediate transport must be a PRIMARY concern.
4.	NEEDLE CRICOTHYROTOMY / OXYGEN	For patients with complete airway obstruction unrelieved by all other less invasive maneuvers. This is a procedure of last resort. Once completed, secure to oxygen source.
5.	MONITOR	Treat rhythm as appropriate.
6.	IV / IO ACCESS	TKO, saline lock, or large bore (trauma) as needed. May initiate adult IO with Base Hospital approval.

APPENDIX

Policy: 45
Date: 8/01/02

NEEDLE CRICOTHYROTOMY

1. Needle cricothyrotomy is an invasive airway procedure of last resort. A base hospital order is not necessary for this procedure. However, careful and complete patient assessment is necessary. It is to be used *only* on those patients who meet ALL of the following criteria:
   - are unconscious and unresponsive
   - are greater than 8 years old
   - have a complete upper airway obstruction - - no movement of air is possible

2. Immediate transport to the closest facility is the primary treatment for persons with complete airway obstruction. In no way should transport be delayed to attempt airway maneuvers or needle cricothyrotomy.

3. Causes of complete airway obstruction include (but are not limited to):
   - 3.1 Foreign body aspiration
     In such cases, ensure at least 2 full cycles of BLS obstructed airway (FBAO) procedures have been performed (refer to policy #6830, Airway Obstruction) prior to consideration of cricothyrotomy. Continue with FBAO measures while preparing for cricothyrotomy. Visualization of the airway to determine appropriateness of Magill forceps use must be done just prior to beginning the cricothyrotomy procedure.
   - 3.2 Isolated trauma to the neck and/or face
     Which makes placement of an ETT or MLA impossible (due to deformity) or where obvious signs of subcutaneous air in the neck region are present. Inability to visualize the vocal cords for ETT placement due to excessive blood and/or vomitus is NOT a reason to perform needle cricothyrotomy. In these instances an MLA should be placed.
   - 3.3 Edema due to anaphylactic / inflammatory response
     Attempts at ETT insertion with a small diameter tube should be made prior to attempting cricothyrotomy.
   - 3.4 Tumor
     This will be a truly rare circumstance, and attempts at small diameter ETT placement should be made first.

4. The following conditions are contraindications to needle cricothyrotomy:
   - inability to identify anatomical landmarks
   - underlying anatomical abnormalities
   - ventilation by any other means
   - valid prehospital DNR - refer to Policy #5620, Do Not Resuscitate.

APPENDIX

Policy: 45
Date: 8/01/02

NEEDLE CRICOTHYROTOMY

5. Placement procedure:
   - 5.1 If no cervical spine injury is suspected, place patient in a "sniffing" position. If cervical injury is suspected, maintain axial stabilization.
   - 5.2 Open kit and prepare equipment by opening antiseptic wipe (not included in kit), attaching catheter to syringe, and threading dilator into airway.
   - 5.3 Identify and palpate the cricothyroid membrane
     With your non-dominant hand, place a finger on the Adam's apple (thyroid cartilage) and slide it down approximately 3 cm (1 -1 1/4 inches).
   - 5.4 Stabilize the area with your thumb and forefinger.
   - 5.5 Prep the area with an appropriate cleansing agent.
   - 5.6 Insert catheter/needle (with syringe attached) through the cricothyroid membrane directed towards the sternum at an approximate 45° angle.
   - 5.7 While advancing the needle and catheter aspirate the syringe to confirm placement by free air return.
   - 5.8 Once airway placement is confirmed, remove syringe and needle, leaving the catheter in place.
   - 5.9 Advance the guidewire through the catheter and into the airway at least 2 inches.
   - 5.10 Remove the catheter, leaving the guidewire in place.
   - 5.11 Advance the airway/dilator assembly, grey end first, over the guidewire until it is visible at the handle (white) end. *Always maintain this proximal end of the guidewire* to prevent inadvertent loss of the wire into the trachea.
   - 5.12 Once the grey tip of the dilator is in contact with the skin, make a small vertical puncture with the blade to widen the opening for the airway/dilator assembly.
   - 5.13 *Maintaining the position of the guidewire*, advance the airway assembly over the wire and completely into the trachea, *taking care NOT to advance it past the tip of the guidewire in the trachea.*
   - 5.14 Remove the guidewire and dilator simultaneously, taking care to maintain the position of the airway catheter.
   - 5.15 Fix the airway catheter into place with the tie tape.
   - 5.16 Connect an appropriate oxygen source (BVM).

6. In addition to documentation on the PCR of the procedure and the patient's response to it, the EMT-P shall complete and submit a Procedure Evaluation form as per agency policy.

Needle Cricothyrotomy - - procedure evaluation for optional scope

This form is to be completed by the paramedic attempting the needle cricothyrotomy procedure, signed by the receiving MD and turned into the QA manager with a copy of the PCR. It should be received by the EMS Agency within 72 hours.

Employing Agency: _____ Call / Run #: _____ Date of procedure: _____

Age of patient: _____ Approx. weight: _____ kg / lb

Type of call: FBAO anaphylaxis T/C other trauma (specify)_____

tumor other (specify) _____

TIMES: of recognition of need for procedure: _____

when procedure begun: _____

procedure completed or attempt stopped: _____

Was adequate ventilation achieved? Y N

As determined by (method): _____

Patient related difficulties encountered (please identify all problems and be specific/explain each choice)

Difficult land marks due to: pt's own anatomy traumatic injury other

_____

_____

Excessive blood (from initial injury) vomitus in airway Suction? Y N

Excessive bleeding from cric site

Other _____

Equipment (equip) difficulties: equip contaminated equip fell apart/broke equip pieces lost

equip hard to manipulate resistance on insertion difficult to ventilate

difficult to maintain in place other _____

Name of EMT-P (print clearly) _____

Signature: _____ Date: _____

To be completed by receiving ER MD or Trauma Surgeon:

Was airway patent on pt's arrival to ED? Y N Was airway in the correct anatomical location? Y N

Patient disposition: Died in ED Died in OR Admitted

Comments: _____

_____

Name of physician (print clearly): _____ Recvg Hosp: _____

Signature: _____ Date: _____

Item 8 -- Training and competency testing

Needle Cricothyrotomy Training Program

Minimum 4 hours

OVERALL COURSE OBJECTIVE

At the completion of this course, the paramedic will be able to integrate assessment findings and psychomotor skills to establish an airway management algorithm, with interventions ranging from simple administration of oxygen to needle cricothyrotomy.

REVIEW OBJECTIVES

Upon review of concepts, the paramedic will be able to:

1. Explain the primary objective of airway maintenance.
2. Identify commonly neglected prehospital skills related to airway maintenance, identify the etiology of skills loss and describe methods of maintaining skills.
3. Explain the anatomy and describe the functions of the upper and lower airway.
4. Describe causes of upper airway obstruction.
5. Describe the indications, contraindications, advantages, disadvantages, complications, and technique for ventilating a patient by:
   a. Mouth-to-mouth
   b. Mouth-to-nose
   c. Mouth-to-mask
   d. One, two and three person bag-valve-mask
   e. Flow-restricted, oxygen-powered ventilation device
   f. Above ventilation techniques for patients with stomas
6. Discuss the indications, contraindications, advantages, disadvantages, complications, and technique for using a dual lumen airway.
7. Discuss the indications, contraindications, advantages, disadvantages and complications, and techniques for endotracheal intubation

CORE OBJECTIVES

At the completion of this unit, the paramedic student will be able to:

Cognitive Objectives

1. Define and explain the implications of partial airway obstruction with good and poor air exchange.
   Key principle: Given a patient with an airway obstruction, differentiate between good and poor air exchange.
2. Define complete airway obstruction.

3. Describe causes of respiratory distress
   Key principles: Discriminate the degrees of respiratory distress.
   Discuss the relationship / non-relationship between obstruction and distress.
4. Describe the appropriate progression in the use of manual airway maneuvers.
5. Describe the Sellick maneuver (cricoid pressure) and its uses.
6. Explain the causes of gastric distention as related to airway maintenance and detail methods to reduce distention.
   Key principles: I/E ratios, compliance and resistance
7. Describe the continuum of complete airway obstruction maneuvers, from Heimlich to use of laryngoscopy and Magill's forceps.
8. Describe the indications, contraindications, advantages, disadvantages, complications, equipment and technique for performing a needle cricothyrotomy.
9. Compare and contrast the airway anatomy of an adult with that of a small (under 9 yrs) child. Use this information to explain why a needle cricothyrotomy should not be performed on a person 8 yrs of age or younger.
10. Discuss the special considerations in airway management and ventilation for patients with facial injuries.
11. Compare and contrast the methods of assessment for confirming correct placement of an airway adjunct.
12. Demonstrate an understanding of county policies/procedures for airway maintenance including appropriate documentation.

Affective Objectives

1. Defend the need to oxygenate and ventilate a patient.
2. Defend the necessity of establishing and/or maintaining patency of a patient's airway.
3. Qualify the use of needle cricothyrotomy in airway maintenance.
4. Comply with standard precautions to defend against infectious and communicable diseases.
5. Defend the need for thorough and appropriate documentation of care.

Psychomotor Objectives

1. Perform and adapt body substance isolation (BSI) procedures during basic airway management, advanced airway management, and ventilation.
2. Perform and adapt manual airway maneuvers, including:
   a. Opening the mouth
   b. Head-tilt/chin-life maneuver
   c. Jaw-thrust without head-tilt maneuver
   d. Modified jaw-thrust maneuver
3. Perform and adapt basic complete airway obstruction / foreign body removal maneuvers, including:
   a. Heimlich maneuver
   b. Finger sweep
   c. Chest thrusts
   d. Removal with Magill forceps incorporating direct laryngoscopy

4. Demonstrate ventilating a patient by the following techniques, adapting as necessary to specific situations:
   a. Mouth-to-mouth ventilation
   b. One, two, and three person bag-valve-mask
   c. Flow-restricted, oxygen-powered ventilation device
   d. Mouth-to-stoma
   e. Bag-valve-mask-to-stoma ventilation
   f. Automatic transport ventilator (optional)
5. Intubate the trachea by the following methods
   a. Orotracheal intubation
   b. Nasotracheal intubation
   c. Multi-lumen airways
6. Perform needle cricothyrotomy on a variety of patient types and under various conditions demonstrating adaptation of basic procedures/techniques to specific situation.
7. Perform assessment to confirm effective airway management.

These are only the *minimum* objectives required of the approved training class for needle cricothyrotomy. Agencies and departments are encouraged to add additional topics and objectives based on their unique personnel and training needs.

The needle cricothyrotomy task force has created these objectives as the basis for development of a train-the-trainer program. In this way, each department/agency will be able to meet the needs of their current personnel and any future hires. The task force recommends that physician involvement be included in the train-the-trainer program as well as the individual department programs, and anticipates the direct involvement of ED physicians and program medical directors.

Needle Cricothyrotomy

Declarative Lecture

I. Introduction to Airway Management

A. The most basic and essential Pre-hospital skill – Often taken for granted
B. Proper techniques of airway management
   1. BVM seal
   2. Proper positioning
   3. Continual reassessment

II. Anatomy of the Airway

A. The essential function of the airway
   1. Warm
   2. Filter
   3. Humidify
B. Pharynx
   1. Nasopharynx
      a. Orientation of nasal floor is towards the ear, not the eye
      b. Turbinate
         i. Parallel to nasal floor
         ii. Provide increased surface area for air
            a. Filtration
            b. Humidifying
            c. Warming
      c. Sinuses - Fracture of certain sinus bones may cause cerebrospinal fluid (CSF) leak.
      d. Tissues extremely delicate and vascular - Improper or overly aggressive placement of tubes or airways will cause significant bleeding which may not be controlled by direct pressure.
   2. Oropharynx
      a. Tongue - Most common airway obstruction
      b. Palate
      c. Epiglottis
      d. Vallecula
         i. "Pocket" formed by the base of the tongue and epiglottis
         ii. Essential landmark for endotracheal intubation
C. Larynx
   1. Attached to hyoid bone
      a. "Horseshoe-shaped" bone between the chin and mandibular angle
      b. Supports the trachea
      c. Made of cartilage
   2. Thyroid cartilage
      a. First tracheal cartilage
      b. "Shield-shaped"
         i. Cartilage anterior
         ii. Smooth muscle posterior
      c. Laryngeal prominence
         i. "Adam's Apple" anterior prominence of thyroid cartilage
         ii. Glottic opening directly behind
   3. Glottic opening

a. Narrowest part of adult of adult trachea
b. Patency heavily dependent on muscle tone
c. Contain vocal bands
i. White bands of cartilage
ii. Produce voice

4. Arytenoid cartilage
a. "Pyramid-like" posterior attachment of vocal bands
b. Important landmark for endotracheal intubation
5. Pyriform fossae - "Hollow Pockets" along the lateral borders of the larynx
6. Cricoid ring
a. First tracheal ring
b. Completely cartilaginous
c. Compression occludes esophagus (Sellick maneuver)
7. Cricothyroid membrane
a. Fibrous membrane between cricoid and thyroid cartilage
b. Site for surgical and alternative airway placement
8. Associated structures
a. Thyroid gland
i. Located below cricoid cartilage
ii. Lies across trachea and up both sides
b. Carotid arteries - Branches cross and lie closely alongside trachea
c. Jugular veins - Branch across and lie close to trachea

D. The Lower airway
1. From fourth cervical vertebrae to xiphoid process
2. From glottic opening to pulmonary capillary membrane

III. Lung/Respiratory Volumes

A. Total lung volume
1. Average adult, 6 liters
2. Not all inspired air enters alveoli

B. Tidal volume
1. Volume of gas inhaled or exhaled during a single respiratory cycle
2. 5-7cc/kg (500cc normally)

C. Dead space air - Air remaining in air passageways, unavailable for gas exchange (approx. 150cc)

D. Residual volume - Volume of air remaining in lungs at the end of maximal expiration

E. Alveolar air
1. Air reaching the alveoli for gas exchange (alveolar volume)
2. Approximately 350cc

IV. Respiration

A. Definition – movement of air into and out of the lungs, removal of waste gasses and regulation of acid base balance by exchange of gases (O2, CO2) between a living organism and its environment

B. Phases
   1. Inspiration
      a. Stimulus to breath initiates from respiratory center
      b. Diaphragm contracts - "flattens" - causing intrapulmonic pressure to fall slightly below atmospheric pressure.
      c. Ribs elevate and expand
      d. Air is drawn into lungs like a vacuum
   2. Expiration - Natural elasticity – "recoil" - of the lungs passively expires air.

C. Oxygen content of blood
   1. Oxygen is carried
      a. Bound to hemoglobin (SaO2)
      b. Dissolved in plasma (PaO2)
   2. Approximately 97% of total O2 is bound to hemoglobin
   3. O2 saturation
      a. Percentage of hemoglobin saturated
      b. Normally greater than 98%

D. Carbon dioxide content of the blood (PaCO2) – Approximately 33% is bound to hemoglobin.

V. Pathophysiology of Obstruction

A. Tongue - Most common airway obstruction
B. Foreign body -May cause partial or full obstruction
C. Laryngeal spasm and edema
   1. Spasm
      a. Spasmodic closure of vocal cords
      b. Most frequently caused by trauma from over aggressive technique during intubation.
   2. Edema
      a. Glottic opening becomes extremely narrow or totally obstructed
      b. Most frequently caused by
         i. Epiglottitis (a bacterial infection of the epiglottis)
         ii. Anaphylaxis (severe allergic reaction)
      c. Relieved by forceful upward pull of the jaw
D. Fractured larynx - Fractured laryngeal tissue increases airway resistance by decreasing airway size through three causes:
   1. Decreasing muscle tone
   2. Laryngeal edema
   3. Ventilatory effort
E. Aspiration - Significantly increases mortality
   1. Obstructs airway
   2. Destroys delicate bronchiolar tissue
   3. Introduces pathogens
   4. Decreases ability to ventilate

VI. Airway evaluation

A. Recognition of airway problems
   1. Respiratory distress
      a. Upper and lower airway obstruction
      b. Inadequate ventilation
      c. Impairment of the respiratory muscles
      d. Impairment of the nervous system
         i. Mechanical/trauma
         ii. Chemical or drugs
   2. Dyspnea may be result of or result in hypoxia or increased oxygen demand
   3. Recognition and treatment of dyspnea is crucial to patient survival. Expert assessment and management is essential because all therapies fail if airway in inadequate.
   4. Visual techniques
      a. Position
         i. Tripod positioning
         ii. Orthopnea
      b. Rise and fall of chest
      c. Gasping
      d. Color of skin
      e. Flaring of nares
      f. Pursed lips
      g. Retraction
         i. Intercostal
         ii. Suprasternal notch
         iii. Supraclavicular fossae
         iv. Subcostal
      h. Paradoxical notion
   5. Auscultation techniques
      a. Air movement at mouth and nose
      b. Bilateral lung fields equal
      c. Audible airway sounds
   6. Palpation techniques
      a. Air movement at mouth and nose
      b. Chest wall
         i. Paradoxical motion
         ii. Retractions
   7. Bag-valve-mask – Resistance or changing compliance with bag-valve-mask ventilations
   8. Modified forms of respiration
      a. Protective reflexes
         i. Cough
            a. Forceful, spastic exhalation
            b. Aids in clearing bronchi and bronchioles
         ii. Sneeze – clears nasopharynx
         iii. Gag reflex – spastic pharyngeal and esophageal reflex from stimulus of the Posterior pharynx
      b. Sighing
         i. Involuntary deep breath that increases opening of alveoli
         ii. Normally sigh about once per minute
      c. Hiccough – intermittent spastic closure of glottis

9. Respiratory pattern changes
    a. Cheyne-stokes
        i. Gradually increasing rate and tidal volume followed by gradual decrease
        ii. Associated with brain stem insult
    b. Kussmaul's breathing
        i. Deep, gasping respirations
        ii. Common in diabetic coma
    c. Biot's respiration
        i. Irregular pattern, rate, and volume with intermittent periods of apnea
        ii. Increased intracranial pressure
    d. Central neurogenic hyperventilation
        i. Deep rapid respirations similar to Kussmaul's
        ii. Increased intracranial pressure
    e. Agonal
        i. Slow, shallow, irregular respirations
        ii. Resulting from brain anoxia
10. Inadequate ventilation occurs when body cannot compensate for increased O2 demand or maintain O2/CO2 balances and may cause:
    a. Infection
    b. Trauma
    c. Brainstem insult
    d. Noxious or hypoxic atmosphere
    e. Renal failure
    f. Gastric Distention
    g. Recognized by resistance to bag-valve-mask ventilation
    h. Reassess: head position – volume, pressure, rate
    i. Prepare for possible regurgitation

B. Specific respiratory changes
    a. Change in Respiratory rate
    b. Change in Respiratory effort
    c. Change in Respiratory volume

VII. Supplemental oxygen therapy

A. Delivery devices
B. Nasal cannula with optimal delivery: 40% at 6L/min
C. Simple face mask
    1. Indications
    2. Delivery of moderate to high O2 concentrations
    3. Range – 40-60% at 10L/min
        a. Disadvantages
        b. Delivery of volumes beyond 10L/min does not enhance O2 concentrations
        c. Delivery of volumes below 8L/min does not provide adequate oxygenation
    4. Non-re-breather mask – Range: 80-95+% at 15L/min

VIII. Airway obstructions

A. Causes
   1. Tongue
   2. Foreign body
   3. Laryngeal spasm
   4. Laryngeal edema
   5. Trauma
   6. Aspiration

B. Classifications/Assessments
   1. Complete obstruction – emphasis signs and symptoms
   2. Partial obstruction – emphasis signs and symptoms
      a. With good air exchange
      b. With poor air exchange

C. Management
   1. Heimlich maneuver
   2. Finger sweep = adult vs. child
   3. Chest thrusts
   4. Suctioning
   5. Direct laryngoscopy for the removal of foreign body when patient is unconscious, BLS methods fail, and you are unable to ventilate and
      i. Insert Laryngoscope blade into patient's mouth
      ii. If foreign body is visualized, carefully and deliberately remove foreign body with magill forceps
   6. Intubation
   7. MLA
   8. Airway management special considerations for patients with facial injuries
      a. Facial injuries suggest the possibility of cervical spine injury
         i. In-line stabilization
         ii. Trauma technique endotracheal intubation
      b. Foreign body / blood in oropharynx – suction airway
   9. Needle Cricothyrotomy

D. Needle Cricothyrotomy – access to the airway through the Cricothyroid membrane
   1. Indications
      a. Inability to ventilate the patient by any other means
      b. Total upper airway obstruction
      c. Massive facial or neck trauma
      d. Edema
         i. Anaphylactic
         ii. Inflammatory response
      e. Tumor
   2. Contraindications
      a. Ability to ventilation by any other means
      b. Inability to identify anatomical landmarks
      c. Underlying anatomical abnormalities
      d. 8 years and under
      e. Valid pre-hospital DNR
   3. Equipment
      a. Melker Kit
      b. Bag-valve-mask
   4. Complications
      a. Incorrect placement
      b. Thyroid gland damage
      c. Severe bleeding
      d. Subcutaneous emphysema
      e. Laryngeal nerve damage

5. Placement procedure
   a. If no cervical spine injury is suspected, place patient in a "sniffing" position. If cervical injury is suspected, maintain axial stabilization.
   b. Setup equipment
      i. 18g catheter/supplied in kit
      ii. Guide wire
      iii. Scalpel
      iv. Dilator
      v. Airway catheter
         a. Advance the handled dilator, tapered end first, into the connector end of the airway catheter until the handle stops against the connector.
         b. Use of lubrication on the surface of the dilator may enhance fit and placement of the emergency airway catheter.
      vi. Bag-valve-mask
   c. Identify the cricothyroid membrane between the cricoid and thyroid cartilages.
   d. With the 6cc syringe attached to the 18 gauge catheter introducer needle, advance it through the cricoid membrane into the airway at a 45 degree angle to the frontal plane in the midline in a caudad direction. When advancing the needle forward, verification of entrance into the airway can be confirmed by aspiration on the syringe resulting in free air return.
   e. Remove the syringe and needle, leaving the catheter in place. Advance the soft, flexible end of the wire guide through the catheter and into the airway several centimeters.
   f. Remove the catheter, leaving wire guide in place.
   g. Advance the emergency airway access assembly over the guide wire until the proximal stiff end of the guide wire is completely through and visible at the handle end of the dilator. Note: It is important to always visualize the proximal end of the guide wire during airway insertion procedure to prevent its inadvertent loss into the trachea.
   h. Maintaining the guide wire position, advance the emergency airway access assembly over the guide wire with reciprocating motion, until it reaches the skin. Make a vertical incision using the #15 short handle scalpel blade. Advance the assembly completely into the trachea, taking care not to advance the tip of the dilator beyond the tip of the guide wire within the trachea.
   i. Remove the guide wire and dilator simultaneously
   j. Fix the emergency airway catheter in place with the cloth tracheostomy tape strip in a standard fashion.
   k. Connect the emergency airway catheter to the bag-valve mask.

IX. Review Policy and Procedure

Needle Cricothyrotomy

Skills

I. Manual Maneuvers

A. Head-tilt/chin-lift maneuver
   1. Technique
      a. Tilt head back
      b. Lift chin forward
      c. Open mouth
   2. Indicated for unresponsive patients who do not have mechanism for c-spine injury
   3. Contraindications
      a. Awake patients
      b. Possible c-spine injury
   4. Advantages
      a. No equipment required
      b. Simple
      c. Safe
      d. Non-invasive
   5. Disadvantages
      a. Head tilt hazardous to c-spine injured patients
      b. Does not protect from aspiration

B. Jaw-thrust without head-tilt maneuver
   1. Technique
      a. Head is maintained neutral
      b. Jaw is displaced forward
      c. Lift by grasping under shin and behind teeth
      d. Mouth opened
   2. Indicated for patients who are
      a. Unresponsive
      b. Unable to protect their own airway
      c. May have c-spine injury
   3. Advantages
      a. May be used in c-spine injury
      b. May be performed with cervical collar in place

C. Modified jaw-thrust maneuver
   1. Technique
      a. Head maintained neutral
      b. Jaw is displaced forward at mandibular angle
   2. Indications
      a. Unresponsive
      b. Cervical spine injury
      c. Unable to protect own airway
      d. Resistance to opening mouth
   3. Advantages
      a. May be used in c-spine injury
      b. May be performed with cervical collar in place

II. *Suctioning*

A. Suctioning the upper airway
   1. Mortality increases significantly if aspiration occurs
   2. Pre-oxygenate if possible
   3. Hyper-oxygenate after suctioning

B. Tracheo-bronchial suctioning
   1. Use sterile technique, if possible
   2. Pre-oxygenation essential
   3. Do not exceed 15 seconds
   4. Ventilate and oxygenate

III. *Ventilation*

A. Mouth-to-Mouth
   1. Indicated for apnea where other ventilation devices are not available.
   2. Contraindicated when communicable disease risk is present.

B. Mouth-to-nose
   1. Indicated for apnea from any mechanism
   2. Biggest disadvantage from direct blood/body fluid contact

C. Mouth-to-Mask
   1. Indicated for apnea from any mechanism
   2. Advantages
      a. Physical barrier between rescuer and patient blood/body fluids
      b. One-way valve to prevent blood/body fluid splash to rescuer

D. One person bag-valve-mask
   1. Fixed volume self inflating bag can deliver adequate tidal volumes and O2 enrichment
   2. Complications
      a. Inadequate tidal volume delivery with
         i. Poor technique
         ii. Poor mask seal
         iii. Gastric distention
      b. Observe for
         i. Gastric distention
         ii. Changes in compliance of bag with ventilation
         iii. Improvement or deterioration of ventilation status

E. Two person bag-valve-mask ventilation method
   1. Indicated whenever bag-valve-mask ventilation is necessary.
   2. Method for use
      a. First rescuer maintains mask seal by appropriate method
      b. Second rescuer squeezes bag

F. Three person bag-valve-mask ventilations
   1. Indicated whenever bag-valve-mask ventilation is necessary.
   2. Method of use
      a. First rescuer maintains mask seal by appropriate method
      b. Second rescuer holds mask in place
      c. Third rescuer squeezes bag and monitors compliance

G. Flow-restricted, oxygen-powered ventilation devices
1. The valve opening pressure at the cardiac sphincter is approx 30cx H2O
2. These devices operate at or below 30cm H2O to prevent gastric distention
3. Indicated for delivery of high volume/high concentration O2 (IL/sec)
4. Contraindicated in small children
5. Advantages
   a. Self administered
   b. Delivers high volume/high concentration O2
   c. O2 delivered in response to respiratory effort (no O2 wasting)
   d. O2 volume delivery is regulated by inspiratory effort minimizing over-inflation risk
   e. O2 volume delivery is also restricted to less that 30cm H2O
6. Disadvantage - Cannot monitor lung compliance
7. Complications
   a. Gastric distention
   b. Barotrauma
8. Method
   a. Mask is held manually in place
   b. Negative pressure upon inspiration triggers O2 delivery or medic triggers release button
   c. Patient is monitored for adequate tidal volume and oxygenation

H. Cricoid pressure – Sellick's maneuver
1. Pressure on cricoid ring
2. Occludes esophagus
3. Facilitates intubation by moving the larynx posteriorily
4. Help to prevent passive emesis
5. Can help minimize gastric distention during bag-valve-mask ventilation
6. Indications
   a. Vomiting is imminent or occurring
   b. Patient cannot protect own airway
7. Contraindicated with caution in cervical spine injury
8. Advantages
   a. Noninvasive
   b. Protects from aspirations as long as pressure is maintained
9. Disadvantages
   a. May have extreme emesis if pressure is removed
   b. Second rescuer required for bag-valve-mask
   c. May further compromise injured cervical spine
10. Complications
   a. Laryngeal trauma with excessive force
   b. Esophageal rupture from unrelieved high gastric pressures
   c. Excessive pressure may obstruct the trachea in small children
11. Method
   a. Locate the anterior aspect of the cricoid ring
   b. Apply firm, posterior pressure
   c. Maintain pressure until the airway is secured with an endotracheal tube

IV. Nasal Airway

A. Soft rubber with beveled tip
   1. Distal tip rests in hypo pharynx
   2. For adults, length measured from nostril to earlobe
   3. Diameter roughly equal to patient's little finer

B. Indications
   1. Unconscious patients
   2. Altered response patients with suppressed gag reflex

C. Contraindicated in presence of facial fracture of skull fracture

D. Advantages
   1. Can be suctioned through
   2. Can be tolerated by awake patients
   3. Can be safely placed "blindly"
   4. Does not require mouth to be open

E. Disadvantages
   1. Poor technique may result in severe epistaxix and may be extremely difficult to control
   2. Does not protect from aspiration

F. Placement
   1. Determine correct length and diameter
   2. Lubricate nasal airway
   3. With bevel towards septum, insert gently along the nasal floor parallel to the mouth
   4. Do not force
   5. Measurement from corner of the mouth to the jaw angle rather than tip of the ear
   6. Too long airway causes airway obstruction

V. Oral Airway

A. Indications
   1. Unconscious patients
   2. Absent gag reflex

B. Contraindicated in conscious patients

C. Advantage - Prevents blockage of glottis by tongue

D. Disadvantage
   1. Does not prevent aspiration
   2. Unexpected gag may produce vomiting

E. Complication - Pharyngeal or dental trauma with poor technique

F. Placement
   1. Place with distal tip toward glottis using tongue depressor as adjunct
   2. Alternate method – place airway with distal tip toward palate and rotate into place

VI. Endotracheal tube

A. Indications
   1. Present or impending respiratory failure
   2. Apnea
   3. Failure to protect own airway

B. Advantages
   1. Provides a secure airway
   2. Protects against aspiration
   3. Route for medication

C. Complications
   1. Bleeding
   2. Laryngeal swelling
   3. Laryngospasm
   4. Vocal cord damage
   5. Mucosal necrosis
   6. Barotrauma

D. Oral-tracheal intubation by direct laryngoscopy
   1. Directly visualizing the passage of an ET tube into the tracheal
   2. Complications
      a. Dental trauma
      b. Laryngeal trauma
      c. Misplacement
         i. Right mainstream
         ii. Esophageal

VII. Nastrotracheal intubation

A. Passage of ET tube through nasopharynx into trachea
B. Indicated in breathing patients with gag reflex, requiring intubation
C. Contraindications
   1. Caution with facial trauma
   2. Caution with deviated septum
D. Advantages
   1. Does not require sniffing position
   2. Patient cannot bite tube
E. Disadvantage - Can only be performed on breathing patients

VIII. Multi-Lumen Airway - Combitube

A. Pharyngeal and endotracheal tube molded into a single unit
B. Alternate airway control when conventional intubation measures are unsuccessful or unavailable
C. Contraindications
   1. Under 16 years of age or under 5.0 ft.
   2. Esophageal trauma or disease
   3. Caustic ingestion

IX. Needle Cricothyrotomy

A. Indications
   1. Total upper airway obstruction
   2. Massive facial or neck trauma
   3. Edema
      a. Anaphylactic
      b. Inflammatory response
   4. Inability to intubate or ventilate the patient by any other means
   5. Tumor

B. Contraindications
   1. Inability to identify anatomical landmarks
   2. Underlying anatomical abnormalities
   3. Ventilation by any other means
   4. 8 years and under
   5. Valid pre-hospital DNR

C. Equipment Assembly
   1. Melkor Kit
   2. 18 g catheter/supplied in kit
   3. Guide wire
   4. Scalpel
   5. Dilator
   6. Airway catheter
   7. Bag-valve-mask

D. Complications
   1. Incorrect placement
   2. Thyroid gland damage
   3. Severe bleeding
   4. Subcutaneous emphysema
   5. Laryngeal nerve damage

E. Placement procedure
   1. If no cervical spine injury is suspected, place patient in a "sniffing" position. If cervical injury is suspected, maintain axial stabilization
   2. Assemble equipment
      a. Advance the handled dilator, tapered end first, into the connector end of the airway catheter until the handle stops against the connector
      b. Use of lubrication on the surface of the dilator may enhance fit and placement of the emergency airway catheter
      c. Identify the cricothyroid membrane between the cricoid and thyroid cartilages
      d. With the 6cc syringe attached to the 18 gauge catheter introducer needle, advance it through the cricoid membrane into the airway at a 45 degree angle to the frontal plane in the midline in a caudad direction. When advancing the needle forward, verification of entrance into the airway can be confirmed by aspiration on the syringe resulting in free air return.
      e. Remove the syringe and needle, leaving the catheter in place. Advance the soft, flexible end of the wire guide through the catheter and into the airway several centimeters
      f. Remove the catheter, leaving wire guide in place
      g. Advance the emergency airway access assembly over the guide wire until the proximal stiff end of the guide wire is completely through and visible at the handle end of the dilator. Note: It is important to always visualize the proximal end of the guide wire during airway insertion procedure to prevent its inadvertent loss into the trachea
      h. Maintaining the guide wire position, advance the emergency airway access assembly over the guide wire with reciprocating motion, until it reaches the skin. Make a vertical incision using the #15 short handle scalpel blade. Advance the assembly completely into the trachea. Care should be taken not to advance the tip of the dilator beyond the tip of the guide wire within the trachea.
      i. Remove the guide wire and dilator simultaneously
      j. Fix the emergency airway catheter in place with the cloth tracheostomy tape strip in a standard fashion
      k. Connect the emergency airway catheter to the ambu-bag
      l. Ventilate and assess for adequate oxygenation

Needle

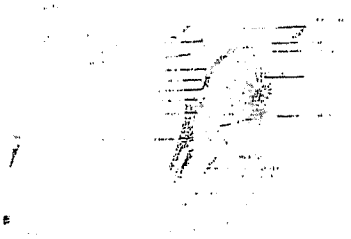
Cricothyrotomy

Student Notes

The Airway

needs darker

The Upper Airway



- *Function*
  - *Warm*
  - *Hu*
- *Anatom*
  - *Nasopha*
  - *Oropharyn*
  - *Larynx*

needs darker

The Lower Airway

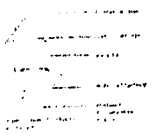
- *Fourth Vertical Vertebrae*
- *Glottic Opening to Pulmonary Capillary Membrane*

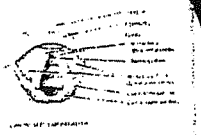
Nasopharynx

- Nasal Orientation towards the ear
- Turbinate
  - Parallel to nasal floor
  - Provides increased surface area for air
    - Filtration
    - Humidification
    - Warming
- Sinuses – Fracture of certain sinus bones may cause CSF leaks
- Tissue is extremely delicate and fragile

Oropharynx

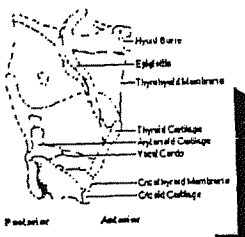
- Tongue – Most common airway obstruction
- Palate
- Epiglottis
- Vallecula
  - "Pocket" formed by the base of the tongue and the epiglottis
  - Important landmark for Endotracheal Intubation

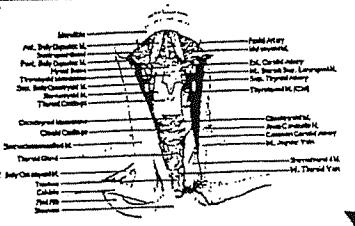




Larynx

- "Horse-shaped" bone between the chin and the mandibular angle – attached to the Hyoid bone.
- Made of cartilage, supports the Trachea
- Laryngeal Prominence – The Adams Apple





- *Arytenoid Cartilage*
- *Pyriform Fossae*
- *Cricoid Ring*
- *Cricothyroid Membrane*
- *Miscellaneous Thy Gland, Carotid Arteries, Jugular Veins*

Respiratory Processes Definitions

- Movement of air in and out of the lungs.

- Removal of waste gases between a living organism and its environment.

Total Lung Volume
Tidal Volu
Dead Space A
Residual Volume
Alveolar Air
Inspiration
Expiration

Oxygen Exchange

- *Oxygen is carried by the hemoglobin (SaO2) and dissolved in plasma (PaO2)*
- *97% of total inspired Oxygen is bou to the Hemoglobin.*
- *SaO2 - Oxygen Saturation*
- *PaO2 - Carbon Dioxide bound to hemoglobin*

Pathophysiology of an Obstruction

Predominate Causes

- *Tongue*
- *Foreign Body*
- *Laryngeal Spasm and/or Edema*
- *Fractured Larynx*
- *Aspiration*

Recognition of Respiratory "Difficulties"

Absolutely Critical to Patient Survival

Respiratory Distress

- Upper and/or Lower Obstructio
- Inadequate Ventilation
- Impairment of the Respiratory Muscle
- Impairment of the Nervous System
  - Mechanical / Trauma
  - Chemical / Drugs

Recognition Techniques

- Visual
- Auscultation
  - Air Movement into/out of Patient.
  - Lung Sounds
- Palpation
- Device Uses

- Modified Forms of Respiration
- Patterned Respiratory Changes
  - Cheyens Stokes
  - Kussmal Breathing
  - Biot's Respiration
  - Central Neurogenic Hyperventilatio
  - Agonal

End Result – Inadequate Ventilation!

Inadequate Ventilation Causes

- Infection
- Trauma – Facial injuries always suggest Cervical Spine injury.
- Brainstem Insult
- Noxious or Hypoxic Atmosphere
- Renal Failure
- Gastric Distention - Must recognize in the resistance to bag-valve ventilation

Supplemental Oxygen Therapy

- Nasal Cannula – 40% at Six Liters
- Simple Face Mask – 40-60% at Ten Liters
  - Note:
    - Delivery at more than 10L/Min does not enhance O2 concentrations.
    - Delivery below 8L/Min does not provide adequate oxygenation.
- Non-Rebreather Mask – 80-95% at Fifteen L/Min

Airway Obstructions / Assessment

Complete Airway Obstruction

Vs.

Partial Airway Obstruction

Causes

- *Tongue*
- *Foreign Body*
- *Laryngeal Spasm/Edema*
- *Trauma*
- *Aspiration*

Management of the Obstructed Airway

- *Basic FBAO Maneuvers*
- *Direct Laryngoscopy*
- *Intubation*
- *MLA*
- *Needle Cricothyrotomy*

Cricothyrotomy - Indications

- ***Inability to Ventilate by Any Other Means***
  - *Total Upper Airway Obstruction*
  - *Massive Facial or Neck Trauma*
  - *Physiologic Edema*
  - *Tumor*

Contra-Indications

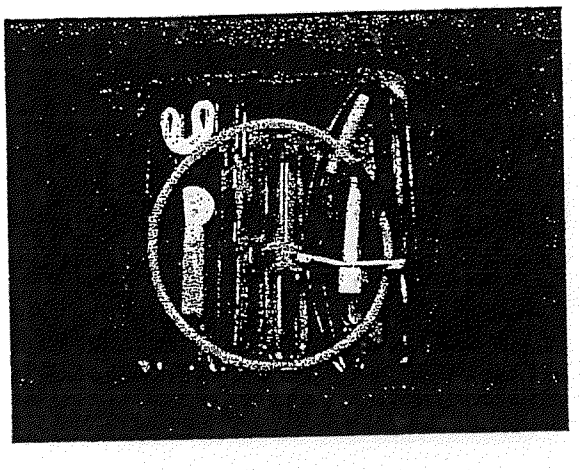
- *Ability To Ventilate By Any Other Means*
- *Inability To Identify Anatomical Landmarks*
- *Underlying Anatomical Abnormalities*
- *Effective Ventilation By Any Other Means*
- *8 years old and under*
- *Valid Pre-Hospital DNR*

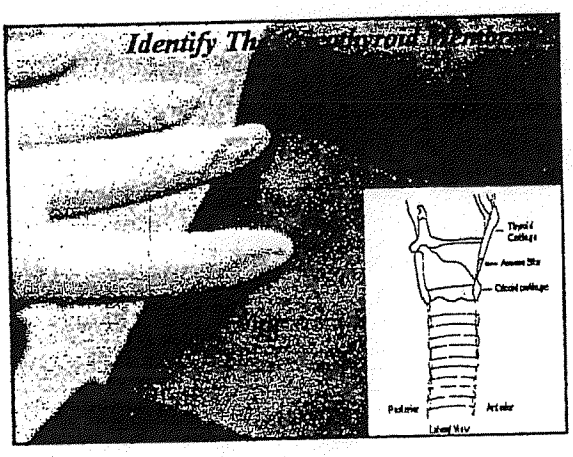
Complications

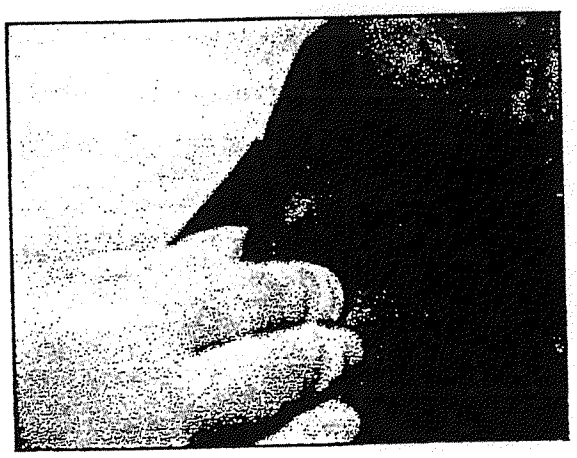
- *Incorrect Placement*
- *Severe Bleeding*
- *Subcutaneous Emphysema*
- *Laryngeal Nerve Damage*
- *Thyroid Gland Damage*

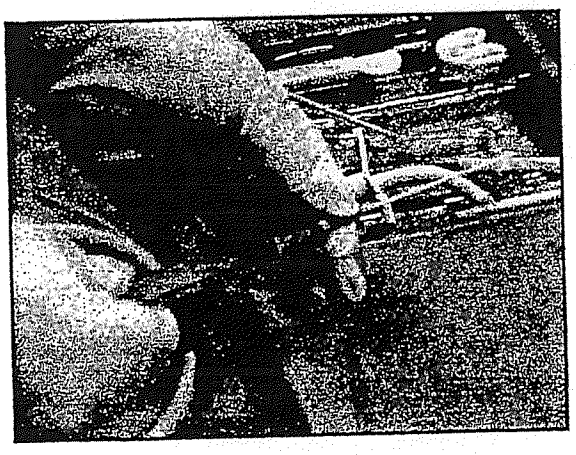
Placement Procedure

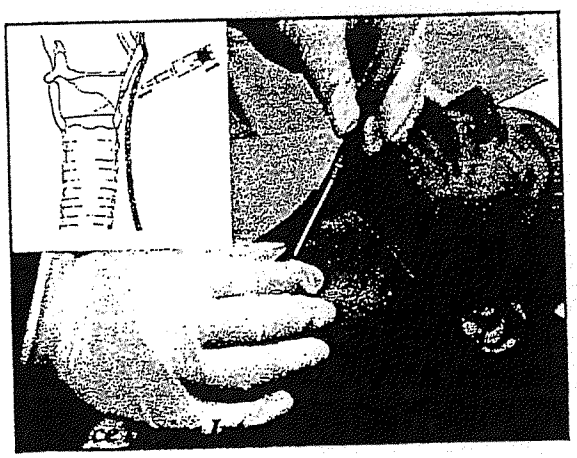
- *Consider Axial Stabilization*
- *Sniffing position*
- *Assemble Equipment*
  - *Melker Kit*
  - *Bag Valve Mask*

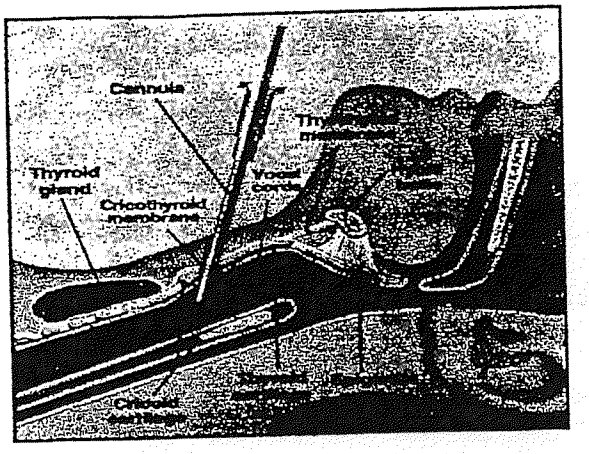


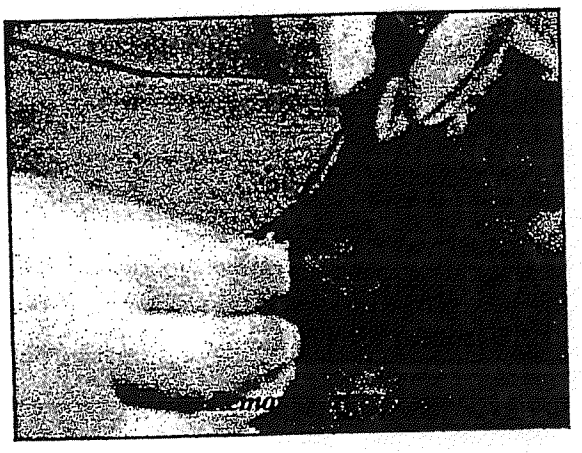

Identify Th
Thyroid Cartilage
Cricoid cartilage
Posterior
Anterior

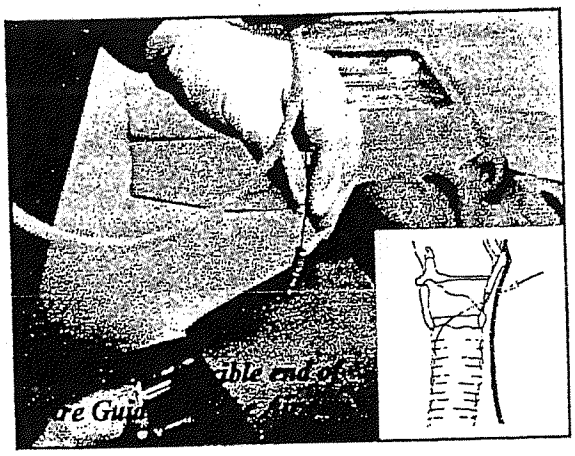


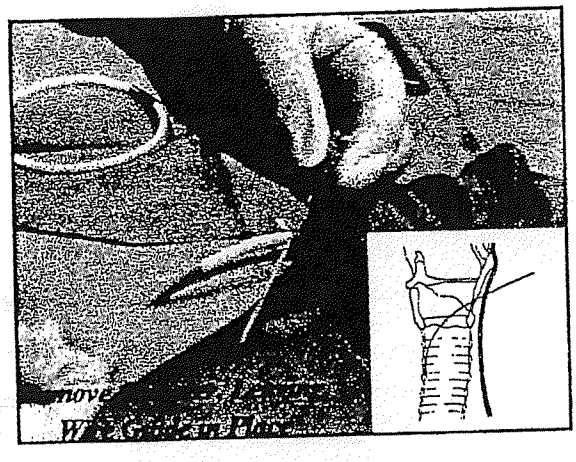


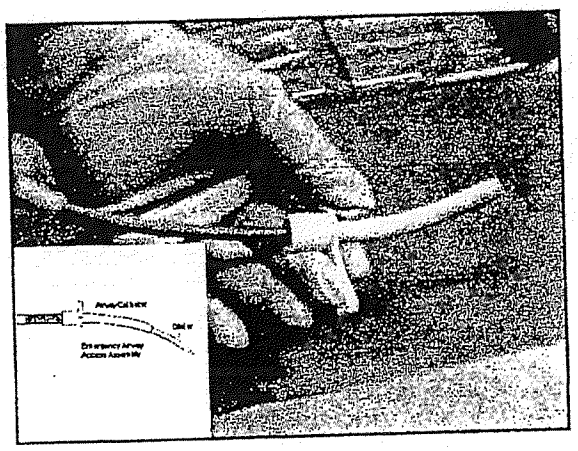


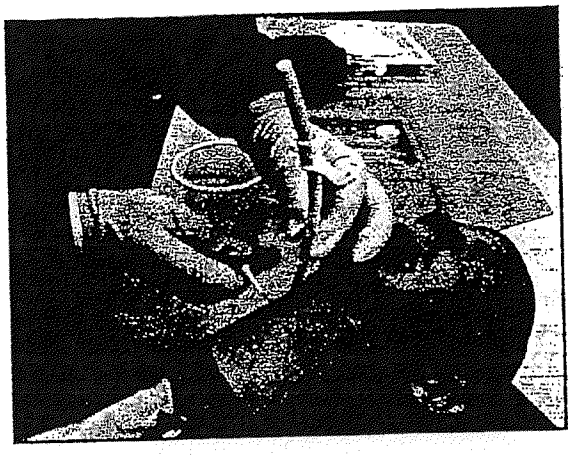

Cannula
Thyroid gland
Cricothyroid membrane

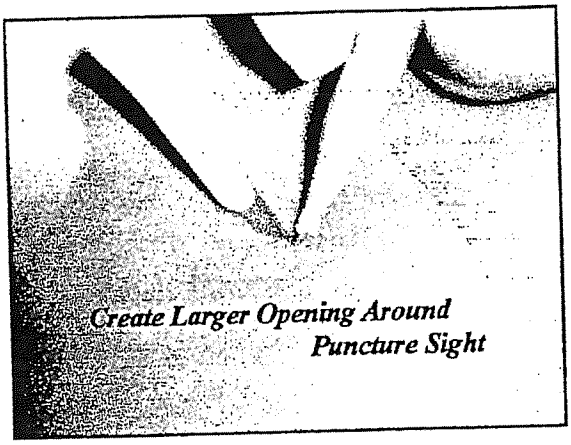


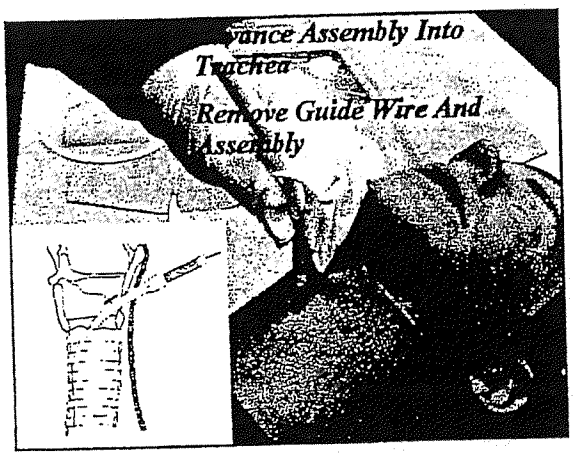


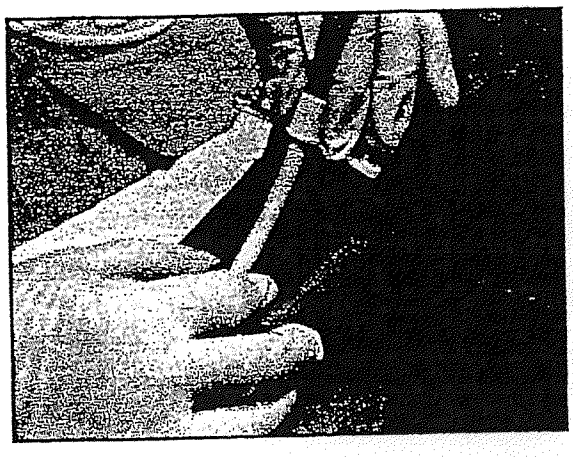


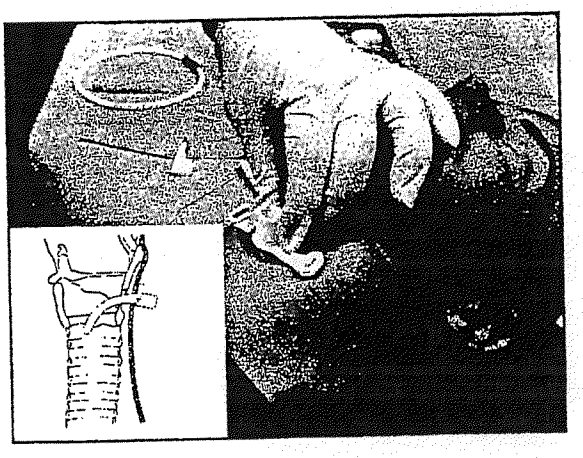


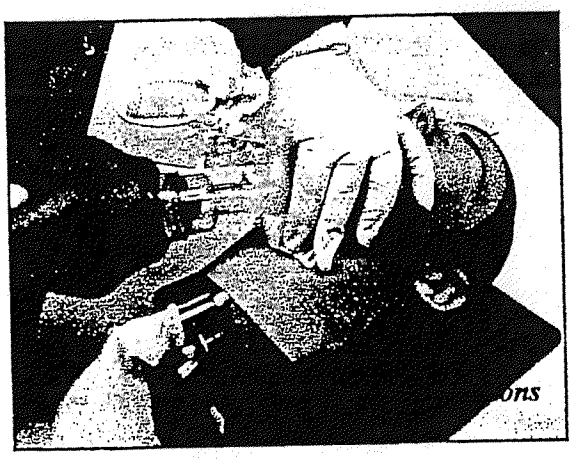


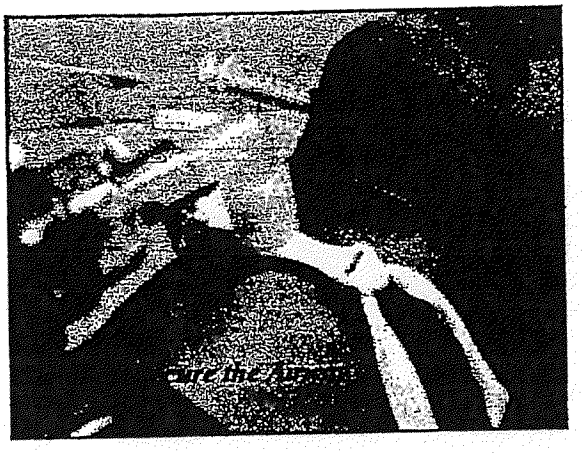

Create Larger Opening Around
Puncture Sight


vance Assembly Into
Trachea
Remove Guide Wire And
Assembly



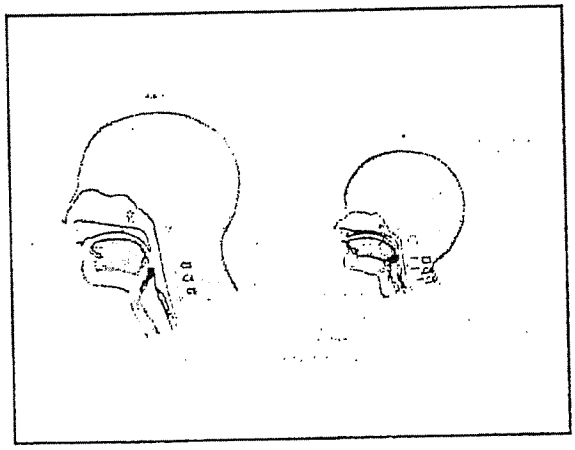


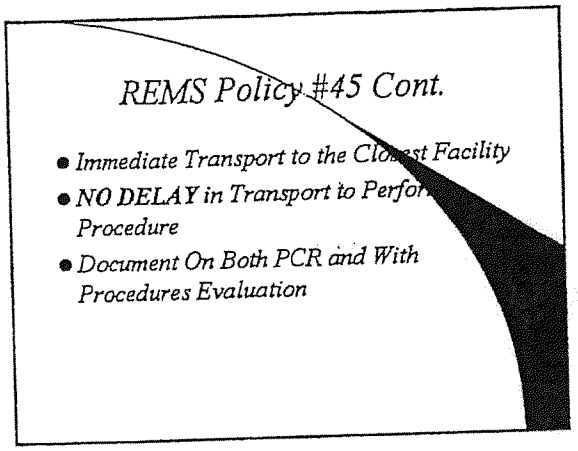


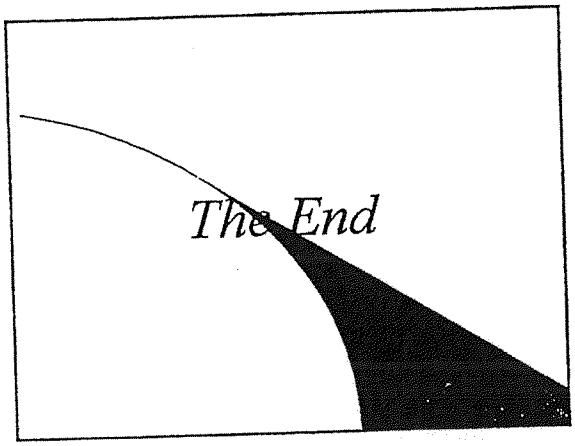


REMS Policy #45

- *Airway of LAST RESORT*
  - *Consider Causes of Complete Obstruction*
  - *Consider Contraindications to Procedure*
- *Must Meet ALL of the Following*
  - *Patient is Unconscious and Unresponsive*
  - *Eight Years Old And Under*
  - *Experiencing a COMPLETE Airway Obstruction Where NO Air Movement is Possible*




REMS Policy #45 Cont.
Immediate Transport to the Closest Facility
NO DELAY in Transport to Perfor
Procedure
Document On Both PCR and With
Procedures Evaluation


The End